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No. 56



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WEST EUROPE REPORT SCIENCE AND TECHNOLOGY

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CHEMICALS

FRANCE'S NEW 'CARBUROL' PROGRAM OUTLINED

Paris CHIMIE ACTUALITES in French 30 Jan 81 pp 1, 3

[Article: "France Launches its 'Carburols' Program--Fuels from Nonpetroleum Sources"]

[Text] A program of partial substitution of oxygenated products for conventional fuels was presented to the French Council of Ministers on 14 January 1981 by Andre Giraud, minister of industry. These oxygenated products, dubbed carburols, can be manufactured from diverse nonpetroleum resources, namely coal, wood, gas, and plant materials.

The program has been finalized for more than Fr 120 million, including Fr 100 million in public outlays which according to plans would be employed starting in 1981, representing a three-fold increase over the projects implemented so far.

This program is deployed around two principal approaches. The first concerns the manufacture of methanol from various combustible raw materials (wood, coal, gas, lignite, heavy petroleum residuums, oil shales, etc.) in two steps: manufacture of a gas in a gas generation plant followed by transformation of this gas into methanol by passage over a catalyst (similarly, an IFP [French Petroleum Institute] process produces "heavy methanol," a mixture of methanol and higher alcohols which can be mixed more easily with gasoline).

Implementation in Two Phases

The second approach concerns the production of butyl acetone mixtures from a variety of plant materials (straw, corn, Jerusalem artichoke, sugar beet, sugarcane, fodder crops such as alfalfa, etc.) by a process of hydrolysis and fermentation.

Another approach also needs to be mentioned: the manufacture of ethyl alcohol by fermentation of sugars or starches. This approach, for the time being, is on standby status. Indeed, it has some drawbacks, among them the problem of costing dearly in energy and problems with producing a quantity of energy equal to the amount consumed. Furthermore, ethanol does not possess the characteristics of the butyl acetone mixture (miscibility in all proportions, role as third solvent). The cost price of this product would be two to three times the cost price of premium gasoline.

Finally, there is the approach involving manufacturing synthetic gasoline from coal or gas; this approach, which in the case of France does not stand up well in an economic comparison with the approaches previously mentioned, is not being pursued at this stage.

However, even though the two principal approaches which form the basic framework of the carburols program are methanol and the butyl acetone mixtures, it has been stated at the ministry that "the arrangements settled on so far remain open to change, and no choice has been set definitively."

The carburols program will be implemented in two steps. By the end of the first phase, in about 1984-1985, around 1.5 million tons of carburols are to have been introduced into fuels.

The administration has authorized the introduction of oxygenated organic compounds into fuels up to an overall maximum limit of 10 percent.

The reason for this limit is that alcohol can corrode zinc (a zinc alloy is used in automobile carburetors), rubber, and terneplate.

On the other hand, vehicles do not need to be modified to run on a mixture of 10 percent alcohol and 90 percent conventional fuel.

In the second step (not defined at present), the government envisages the creation of a new fuel which would be distributed separately. The transition to this second phase would not be able to occur before about 1984-1985. Installation of special service station pumps for a carburol containing a much greater proportion of non-petroleum products (up to 50 percent) should take place around 1990. The use of such fuels will require the study of specially modified autos. But for the moment the objective of the government is to "move swiftly into the arena of significant and economically competitive industrial applications."

Accordingly, all available resources are being mobilized to attain this goal. On the side of the industry operators, brought together for the first time under the aegis of the ministry of industry will be IFP and, working closely with it, IRCHA [French Institute of Applied Chemistry Research], COMES [Solar Energy Commission], and all of the agencies, including CERCHAR [Center for Studies and Research on French Coal Mines], which participate in the policy decisions for promoting coal. Also participating in this program, under the aegis of the ministry of agriculture, will be INRA [French Institute for Agronomical Research] and CNMA [French Center for Studies on Farm Mechanization].

A Very Ambitious Program

Some studies and trials will be concerned with the resources to employ in the field of biomass. The transformation of this biomass will be studied on a demonstration-plant scale, with plans including several pilot plants which will begin operation in 1981 and 1982: a demonstration plant for gasification of wood using oxygen, a demonstration plant for synthesis of methanol and higher alcohols, and two demonstration plants (or one multipurpose plant) for tests on the butyl acetone approach

for carrying out treatments based on enzymatic hydrolysis (in regard to the general group of cellulosic products, particularly alfalfa and crop wastes) and on acid hydrolysis (in regard to Jerusalem artichoke in particular).

Finally, research will be accelerated in the area of automobiles, and the coal gasification program, which is being jointly developed by GDF [French Gas Company] and CDF [French Coal Board] and is slated to include a demonstration plant, will be coordinated with the effort.

Today, the price of premium gasoline leaving the refinery is about 130.34 Fr/hl, or 1.30 Fr/l.

Looking at the prices of various carburants, it can be seen that methanol produced from combustible starting materials (gas, charcoal, etc.) is competitive right now. Its cost price is between 1.10 Fr/l (in the case of gas) and 1.40 Fr/l (in the case of charcoal).

On the other hand, the profitability in the case of ethanol is not very high. In the best case, the price per liter will be on the order of 3 Fr/l. Furthermore, the administration is not pursuing this approach at present. An assessment in the BULLETIN DE L'INDUSTRIE PETROLIERE suggests that this approach will not be worthwhile unless oil prices rise substantially. Such a case would require that the price of crude increase to about \$70/barrel. Obviously, we are not yet at that stage.

As concerns the production of butyl acetone mixtures, i.e., production involving hydrolysis and fermentation of plant material, a mixture of 65 percent methanol and 35 percent biomass-derived products would cost about 2.10 Fr/l (in the case of Jerusalem artichoke). It is necessary to point out, however, that with Jerusalem artichoke only one harvest is obtained per year. The combination of several crops ought to lower the price to about 1.50-1.60 Fr/l.

Jerusalem artichokes offer the advantage of an abundant haulm which can supply an energy contribution. The yield from a hectare of Jerusalem artichokes could be on the order of 70 tons of tubers and 30 tons of haulm, but only on the best lands and at the cost of substantial applications of fertilizer. Nevertheless, this plant adapts to shallower soils and soils of mediocre quality, with far lower yields in such cases. Research still needs to be done on improving the yields and developing appropriate mechanization.

But Jerusalem artichoke is not the only possible plant, and one can already sense a certain bustle on the part of the ministry of agriculture: something to make the farmers happy.

9828

CSO: 3102/190

CHEMICALS

BRIEFS

SWISS STUDY ALCOHOL FUELS--The Swiss government has just entrusted a research contract to Ader [Association for Development of Renewable Energy Sources] for evaluating the actual possibilities for utilization of biomass with a view toward transformation of biomass into an alcohol-base substitute fuel. This investigation should allow the Federal Council (the Swiss government) to evaluate the advisability of conducting trials with decentralized industrial alcohol production facilities. Several communes, members of Ader, have agreed to participate in the study. [Text] [Paris SCOOP ENERGIE in French 15 Feb 81 p 9] 9828

CSO: 3102/190

STIFF COMPETITION IN RACE TO COMMERCIALIZE AMORPHOUS ALLOYS

Paris INDUSTRIES & TECHNIQUES in French 10 Mar 81 pp 22-26

[Article by Alain Perez: "Amorphous Materials: The Era of Applications"]

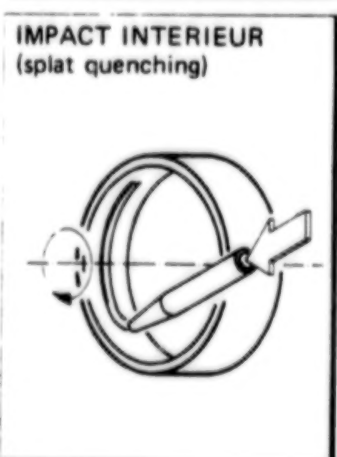
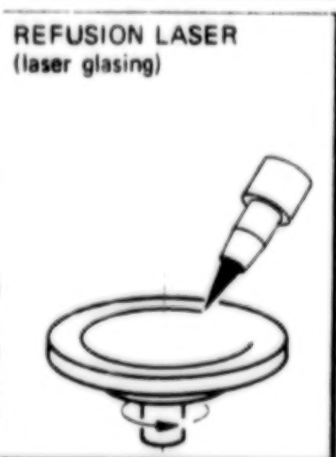
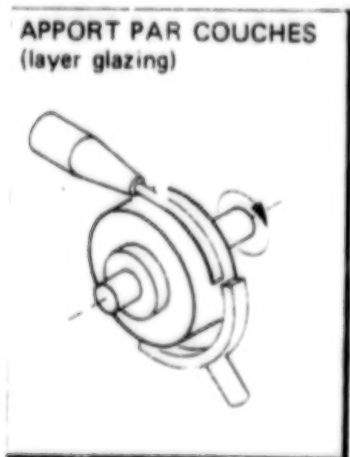
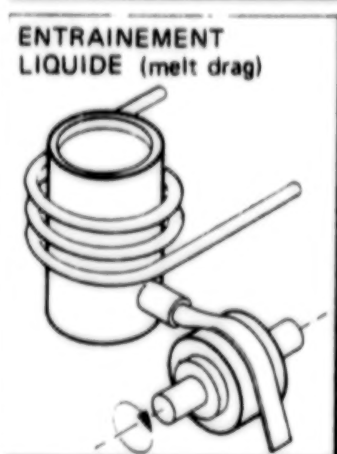
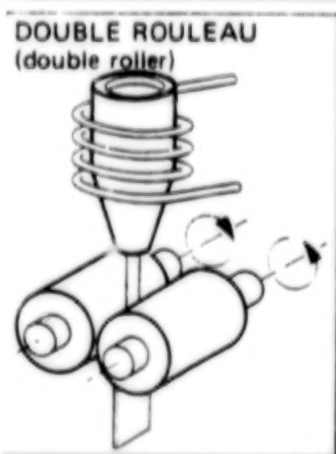
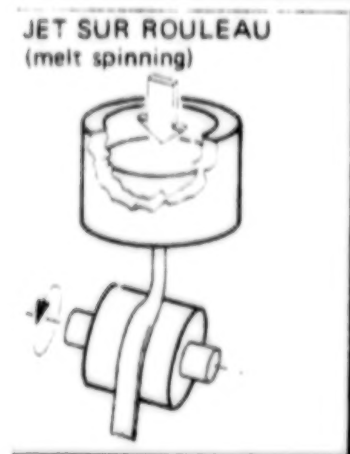
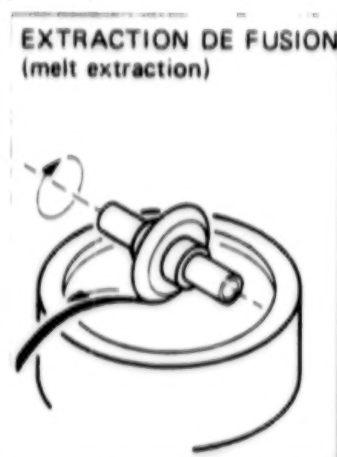
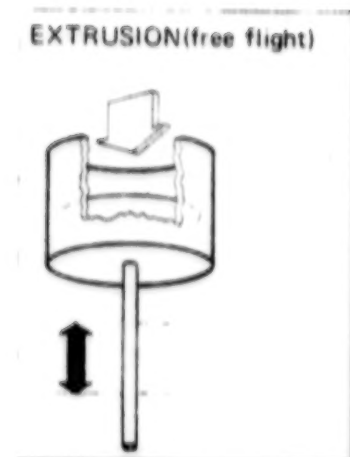
[Text] Discovered 20 years ago, amorphous materials have moved beyond the stage of laboratory curiosities. Their strength, corrosion resistance, and above all, their magnetic properties, held greater promise. Two firms, one of them American and the other West German, are commercializing ribbons intended for brazing in the aeronautics industry. BF transformers, tape recorder heads, bubble memories, other applications are in preparation. Mass production is not very far off.

Since 1976, the American firm Allied Chemical has been offering thin ribbons of nickel-boron amorphous alloy, under the name of Metglas. In FRG, Vacuumschmelze has been manufacturing a similar product named Vitrovac. The glass analogy in these two trade names is justified: amorphous alloys or metallic glasses are non-crystalline solid materials. Their development really started in the early 1960's.

At present, the aeronautics industry is still pioneering applications, but not for much longer. Very recently, an amorphous silicon solar cell was introduced in Japan. Metallic weaves to suppress electromagnetic interference in viewing screens will soon be available. In an even more ambitious project, the Japanese firms Sony and Matsushita intend to use alloys of this type to manufacture tape recorder heads. This will signal the true adoption of this type of material, whose worldwide production at present does not exceed a few hundred tons per year.

Within five years, a new generation of low frequency transformers should emerge, using the magnetic properties of amorphous alloys. Prototypes are being tested, especially in the United States. Once again, the Americans are in the best position; the Germans and Japanese are not far behind; France is not very active. And yet the initial concept of metallic glass came from a Frenchman, Pol Duwez, living in the United States. He is presently continuing his work at the California Institute of Technology. He is also a consultant for the Northwest Battelle Research Center.

There is yet another indicator of the coming importance of these materials: the leading producer, Allied Chemical, recently decided to increase its production capacity ten-fold (from 500 to 5000 t/yr) by building a new production facility in New Jersey. At the same time, the firm is setting up an international distribution and technical service network.



(doc. Battelle)

The Battelle Research Center in Geneva has surveyed nine rapid solidification methods. The melt spinning technique is the most widespread on an industrial scale. The other procedures are essentially used in the laboratory.

The process of amorphous transformation has become familiar as a result of extensive theoretical work. It involves the rapid quenching of a metal, a metalloid, or a mixture of the two in fusion. For the most common alloys, the cooling rate must be between 100,000 and 1 million °C per second. Theoretically, any element can be made amorphous. In actuality, the elements chosen are usually binary, ternary, and quaternary compounds from a family of metals (iron, nickel, or cobalt), and a family of metalloids (boron, phosphorus, silicon, or carbon). Allied Chemical, with heavy investments in this field, has in fact patented all the best combinations -- from an industrial point of view -- of these seven basic elements. The first amorphous alloys obtained in 1960 were of the gold-silicon or platinum-silicon type, which could be made amorphous by simple thermal shock. Since then, efforts to create materials with less noble components have been successful.

Three basic characteristics hold great promise for the future of these new materials: strength, resistance to corrosion, and above all magnetic properties. The resistivity of an amorphous alloy is four times greater than that of a crystalline alloy of the same composition: 250 micro-ohms-cm compared to 60 micro-ohms-cm. The direct consequence is that Foucault current losses are theoretically reduced by 70 percent. In this era of expensive calories, this fact has not been overlooked by American engineers at General Electric and at Westinghouse, which are very active in this field.

In the United States, losses due to thermal dissipation in low frequency transformers are estimated to be 0.5 percent of the country's total electricity production. By replacing mild steel containing 3.6 percent silicon with an iron-boron amorphous alloy, General Electric studies indicate that losses go from 1.4 to 0.4 W per kilogram of core. If total substitution was possible, the heat energy loss would be brought down to 0.2 percent of production. This is far from insignificant on a national scale. A new evaluation is being performed in the United States. This will result in an updated economic assessment, taking 1980 production techniques into account. Paradoxically, these new materials now challenge silicon steel, which has been familiar for a long time and which is inexpensive (on the order of 2 F per kg). If industrial production of amorphous alloys can be achieved economically -- as appears quite possible -- these alloys will find a market very readily.

Many production methods are used. The only problem still to be solved is the thickness of the ribbons. Currently, products available on the market do not exceed 60 microns. Outright substitution requires 300 microns, unless transformers adapted to such thicknesses can be designed. It is not by chance that Allied Chemical and Westinghouse are collaborating on projects. Likewise, General Electric is closely monitoring all activities. Nor is it by chance that the other producer, Vacuumschmelze, is an affiliate of Siemens, another big name in electrical manufacturing.

Four principal methods of production are known today: streaming, extraction, laser, and condensation. The first and best known procedure consists of squirting a stream of alloy of a given composition onto a surface with a high thermal mass. This is usually a cooled revolving cylinder. While the principle behind this technique is



The German steel manufacturer Krupp is also producing amorphous alloys in its laboratory. The technique used (melt spinning) produces ribbons 30 mm wide and 20 microns thick.

simple, it requires precise control of the important parameters: viscosity, streaming rate, temperature, angle of incidence of the stream, and surface condition of the cylinder. The width of the ribbon is from two to three times the diameter of the stream.

The ribbon is then impelled in the direction of the cylinder's rotation at a speed (that of the cylinder) which can reach 30 m/s. All the know-how consists in controlling the parameters. Georges Haour, head of the metallurgy department at the Battelle Research Center in Geneva, states that "as soon as the metal feed is disturbed, the quality is altered." Battelle recently patented a process which yields 100 microns-thick ribbons that are several meters long. The most difficult thing is not to obtain the amorphous state, but rather a constant and uninterrupted ribbon or filament with a good surface. This is then wound using procedures known in the textile industry.

Extraction is the reverse. A cooled disk spins rapidly in a crucible containing the molten metal. A thin filament is then ejected. This technique is especially interesting for obtaining fine amorphous or non-amorphous powders. Battelle is placing high hopes on this process, especially for powder metallurgy. Moreover, if these powders are successfully agglomerated under pressure without exceeding the crystallization temperature, it should be possible to obtain actual ingots of metallic glass.

The most recent technique is the use of laser beams. A coherent light beam is directed onto a moving metal disk. The energy focused on a diameter measuring a few hundredth of a millimeter causes instant and spot fusion of the metal. The disk's own thermal mass assures rapid cooling.

The last important method is cathode sputtering or evaporation. Here, the alloy is evaporated in vacuum and condenses on a substrate. The deposition rate is very slow: on the order of a few millionths of a millimeter per second. At the CNRS

Magnetic Laboratory in Meudon Bellevue, this process is being used on rare earth-metal amorphous deposits. The target here is electronics applications, another field where amorphous materials are indicated. A cobalt-gadolinium ($\text{Co}_{80}\text{Gd}_{20}$) alloy exhibits bubble material properties. The hope is to obtain magnetic "bubbles" with a diameter of 0.3 microns. Present memories have bubbles of 3 microns. Dividing the bubble size by a factor of 10 means multiplying the bubble density per unit area by a factor of 100. The information storage potential increases proportionally. Materials of this type developed at CNRS are still unstable; they only remain amorphous in a temperature range of 10 to 30 °C. With a mixture of neodymium and nickel or iron it is possible to obtain a range of 0 to 40 °C.

Using comparatively modest equipment, Professor Marais' staff in Meudon has also obtained a few more "ordinary" amorphous materials. This equipment includes a copper wheel of 15 cm diameter, turning at 10,000 rpm, on which is squirted a molten drop. Creusot Loire is becoming interested and appears ready to collaborate. This may make it possible to acquire better equipment.

At the Vitry CNRS (metallurgy laboratory), a team has been working on this subject for the past three years. J. Bigot, in charge of the project, explained: "I chose amorphous materials because the manipulation is beautiful." It is indeed impressive to see a thin shiny ribbon unwind at 120 km/hr. But this attitude is fairly rare in French public research. The perfecting of techniques is often considered secondary since it is not taken into account in research careers.

The Vitry group first concentrated on zirconium-copper alloys, to gain experience: "We had chosen the double roller method which is not good. Now we prefer melt spinning, with the great standby elements (Fe, Cr, Ni, B, P, C)." The Vitry group is one of the few in France which is obtaining wide ribbons (15 mm), over lengths of about ten meters. For these results the team is using two wheels, one of copper and the other of steel, turning at 5000 rpm.

Vitry is wondering at present whether to go further. An agreement (DGRST contract) was recently signed with Inphy and CEM. The steel manufacturer will probably take over on a more industrial basis. A similar agreement was also signed between Pont-a-Mousson and CNRS in Nancy. This proves at least that steel manufacturers have become interested in amorphous materials. Recently, Krupp has even offered samples of unclear origin. Mr Bigot feels that "if Krupp is getting involved, it must be important."

In industrial terms, there are still two unknown factors. First, stability: the amorphous state is metastable. It does not age well and little by little it returns to the crystalline state. However, the latest commercialized products are thought to have a lifetime of about 10 years. Secondly, the surface condition is also an unknown: the ribbons being produced today are of average quality and will remain narrow, measuring at most a few hundredths of a millimeter. Therefore there is increasing interest in amorphous powders which would be sintered (without exceeding the recrystallization temperature). The bricks thus obtained could then be machined, opening the way for a new series of applications.

Another important characteristic of some amorphous materials is their corrosion resistance. The non-crystalline structure (absence of grain boundaries) and the natural passivation of the surface layer make these materials particularly resistant to chloride ions. According to results obtained by the Japanese Iron and Steel Institute, an iron-chromium-phosphorus-carbon amorphous alloy with 8 percent chrome is totally oxide resistant in a sodium chloride solution at 30 °C.

This remarkable oxide resistance can be deposited as a thin film. At Battelle, several processes have recently been patented: deposits of iron-base amorphous layers on steel sheets, or deposits of amorphous iron layers by plasma torch. A production method has also been perfected for iron-carbon-phosphorus amorphous alloy filaments, which are corrosion resistant in a sulphur environment.

Another important factor is that amorphous silicon obtained by silane decomposition (SiH_4) possesses properties which are very close to those of crystalline semiconductors. In the amorphous state, silicon becomes more absorbent in the infrared. An additional advantage is that it can be deposited economically on large surfaces. Furthermore, the sunlight conversion yield is higher by 5 percent. This is the principle which the Japanese have commercialized for the first time. An early application will be for office computers which are often used under weak or artificial light.

Another new application coming very soon is the substitution of Permalloy in tape recorder heads. Amorphous materials have better permeability than the best iron-nickel alloys in use today (Supermalloy). In addition they have very good wear resistance. Production techniques are fast. With the help of Nippon Steel, it appears that the leaders of the Japanese electronics industry have mastered the quality problems of mass production.

All these interesting properties are complemented by a degree of mechanical strength which is a match for the best quality steel, being higher than 3000 N/mm^2 . In addition, amorphous alloys are ductile, and some alloy formulations have practically no thermal expansion, as in the case of Invar. In addition to all this, production costs are proving to be increasingly competitive. Rapid solidification methods are generally simple and easily industrialized. Unaccountably, France has remained almost completely uninvolved in a trend which has been developing strongly for about ten years.

Sony in the Lead

The Japanese firm Sony has successfully developed and commercialized the manufacture of an amorphous alloy narrow ribbon, thanks to an original triple roller technique. This process notably makes it possible to obtain films which are not only uniform and stable but above all possess remarkable surface quality. The process includes an extra roller called the large-diameter accelerator roller, which insures final cooling and clean surface condition. This project started in 1978.

One industrial application of the product thus obtained is a new generation of high performance, moving-magnet reading heads. According to the manufacturer, the noise level gain is 5 dB compared to a Permalloy-core head. The core itself is formed from windings of 40 micron-thick ribbons. In this instance the bonding strength of amorphous alloys is an additional advantage. The alloy used in this application is of the iron-nickel-carbon-boron-silicon-germanium type. The proportion of metalloids is believed to be between 15 and 30 percent. The non-crystalline state is maintained up to temperatures of the order of 200 °C.

Everything Patented

"The number of patents related to amorphous materials is beyond belief," stated J. Bigot of the Vitry CNRS, pointing to a bulky file. Pioneers in the field, particularly Allied Chemical, have patented nearly everything. The American firm has even patented the manufacture of razor blades (reputed to be practically indestructible).

But this question does not overly worry the parties concerned. Of course a patent can be filed for a chemical formulation, but protection is difficult. Theoretically, a patent can be altered by the mere addition of an infinitesimal amount of some element. In this particular case things will not be that simple. The influence of these modifications on the stability of the materials obtained is not well-known at this time. If production expands, noteworthy legal battles can be expected.

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ENERGY

THREE-NATION PROJECT TO BE WORLD'S LARGEST SOLAR POWERPLANT

Lisbon O JORNAL in Portuguese 30 Jan 81 Supplement p 1

[Article by Eurico da Fonseca: "The World's Largest Solar Powerplant Will Be Built in Portugal"]

[Text] During the sessions on renewable energy sources recently organized by the Order of Engineers, the director general of energy announced plans to build two solar powerplants in Portugal. What will they be like?

This is not the first time the construction of solar powerplants in Portugal has been announced. Early last year, engineer Alvaro Barreto, then minister of industry and energy, spoke on the RTP [Portuguese Radio-Television System] of the forthcoming construction of a 100 kW solar powerplant, possibly in Alentejo. He described it as a thermoelectric powerplant using Helioman concentrating collectors and producing steam which, through special machines with screw type rotors, activate alternators.

Meanwhile, there was also talk of the construction of another powerplant, in Algarve, which would use photoelectric cells and have a wind-driven generator. The power output of this plant would be much less.

Although it appeared that the decision had been made and that construction would soon begin, the fact is that nothing more has been said on this subject. The reason was easy to understand: with regard to the 100 kW powerplant, its construction depended upon a cooperation agreement to be worked out with the FRG and which only now is to be signed. But there was another obstacle: it was hoped that the Bonn Government would subsidize a large part of the undertaking through the Federal Fund for the Development of New Technologies. However, the 100 kW powerplant could not be considered a true example of new technology, since a number of plants of this type had been (or were to be) built in other parts of the world by the same consortium.

What could in fact be considered as "new technology" was the construction of "tower powerplants" of much higher power output. In those powerplants a large number of flat mirrors (heliostats), activated by computer, concentrate the sun's rays on a chamber at the top of a tower. The chamber may contain water and function like a boiler producing high-temperature steam and activating turbogenerators. The yield is greater than that of powerplants using concentrating mirrors, and the cost per electric kW of nominal power is less, but, naturally, the investment is much greater.

In a meeting of the German Association for Solar Energy held in Lisbon on 9 November 1979, a consortium comprised of the companies Dernier, Interatom, MAN and MBB presented a plan for the construction of a tower powerplant with a power output of 20 MW and using gas heated to 850 degrees Centigrade. It was then announced that the FRG's Ministry for Research was willing to subsidize its construction "in an area having good provisions for insolation." At that point, O JORNAL suggested that the powerplant could well be built in Portugal on the Guadiana River, precisely because of its good insolation conditions. That is the plan now announced and to be carried out in conjunction with Spain not only because of its probable geographical location but also its cost--high despite the German subsidy--and the experience the Spaniards have already acquired. However, it is important to note that there will be a delay in carrying out the project not only because of problems of an administrative nature but also because it presents a real challenge in the technological field, since the powerplant will have double the power output of the largest plant designed up to now--the one in Barstow, New Mexico, which has not yet entered into operation.

Solar Heat for Industry

The other solar powerplant, whose construction was announced and which appears to be a short-term project, is also of German origin but is not intended for the production of electricity. Its objective is to produce heat for industrial processes. In that case, the yield is much higher, in the range of 50 to 60 percent, since it is not affected by the transformation of heat into electricity, which implies great losses due to the relatively low temperature (about 250 degrees Centigrade) of the conductive fluid.

The powerplant using the heat process is not much different, per se, than the 100 kW powerplant initially planned for the production of electrical power. It is made up of Helioman modules consisting of four parabolic mirrors arranged vertically and flanked by piping in which the heat-conveying liquid circulates. The mirrors are constantly pointed toward the sun, as would be expected.

So far as is known, the powerplant will be used for the pasteurization and refrigeration of milk. The heat-conducting liquid is a special oil which resists temperatures greater than 300 degrees Centigrade. When the temperature tends to rise above that limit, the mirrors are automatically turned away from the sun. In principle, this installation would have 66 modules, each having 4 mirrors, a surface area of 32 square meters and concentration equivalent to 42 suns. The total area occupied by the collectors would be 2,112 square meters and the total land area 8,400 square meters, with the modules placed at intervals of 12 meters. The steam production will correspond to a maximum power output of 1 MW with a temperature of 250 degrees Centigrade. For a total of 2,900 hours of sun per year (which is the average in southern Portugal), there will be a total available power output of 3,380 MWh, and production at the outlet of the collector field will be 1,600 MWh of which 1,575 will be used directly as process heat.

Among many other applications, the system can be used in the production of oil, the processing of cork, the canned goods industry and the production of particle board; it can be supplemented with flat collectors (as preheating elements) or with a cascade of concentrating collectors to obtain higher temperatures. However, it should be noted that the utilization of solar heat must be considered principally as a means of promoting fuel economy without dispensing with the use of fuel, inasmuch

as conventional boilers must still be used during periods when there is no sun, or for prolonged night operation which exceeds the storage capacity of heat produced by the solar installation. On the other hand, and contrary to what many industrialists think, the fact that a normal solar installation produces heat at 250 degrees Centigrade does not mean that it is not of interest in applications which require higher temperatures. Solar heat can be used in preheating and, in any case, leads to an appreciable saving in fuel consumption.

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CSO: 1107

ENERGY

TECHNICAL PROBLEMS ARISE WITH SOLAR POWERPLANTS

Stockholm SVENSKA DAGBLADET in Swedish 18 Jan 81 p 6

[Article by Dag Bjerke]

[Text] It is difficult to utilize solar energy in Sweden. Many technical problems have arisen at the country's three solar heating plants now in operation: corrosion, blocked filters--and not enough clear blue skies.

That is what emerges from a comprehensive report on operation of the solar heating plants, which are located outside Linköping (Lambohov) and Vaxjö (Ingelstad) and in Studsvik.

The report, which will be made public when it reaches the Council for Building Research on Monday, points out that those plants are to be seen as isolated development projects at what is technically a very early stage.

At Lambohov, which has been in operation since the spring of 1980, there are stationary flat solar collectors on the roofs of 55 row houses. The problems with the solar collectors themselves have been corrosion in parts of the system, condensation and dust within the collectors, and minor problems with freezing.

The corrosion seems to be related in part to the Lambohov project's biggest problem, which is the water. The same water circulates throughout the system, and heat exchangers are not used before the system enters the houses, where the heat is then transferred to air.

In freezing weather, and to reduce heat losses when solar irradiation is insufficient, the solar collectors at Lambohov are drained of their soft and originally acidic water, which is not protected from freezing. All those draining operations, which frequently occur several times in a 24-hour period, combined with the low pressure in the system let a lot of air in and may have oxygenated the water.

The soft, acidic, and oxygenated water has caused big problems with corrosion, deposits of various impurities, and so on. It has resulted in filters being blocked by a gley-like mass, half of which turned out to consist of bacteria, while the other half was made up of sand, metal flakes, plastic, and glass splinters, together with high percentages of copper, iron, and calcium.

As a result of the blocked filters, the solar-heated water did not reach the residences.

"Rubber Pancake"

There were problems with leakage in the big water tank used to store heat which is captured by the solar collectors but not needed immediately. Almost 2 cubic meters of the total 10,000 being stored leaked out during each 24-hour period.

One reason for that is thought to be the difficulties encountered in attaching the thin rubber sheeting used as a sealer between the tank's concrete walls and the water. It was delivered in a single piece weighing a total of 5 tons and with a diameter of over 30 meters.

Getting that gigantic, soft, and limp "pancake" into place without making holes is an almost impossible job, as the leakage of water indicates.

No Heat Stored

At Ingelstad, movable concentrating solar collectors were used. They function best in sun from a clear sky. They are not good at capturing so-called diffuse radiation.

During the almost 2 years that the facility has been in operation, there has been far more diffuse radiation than was expected, with the result that the amount of heat collected was far from what had been contemplated.

This meant that the heat storage capacity of 5,000 cubic meters of water was hardly used at all--all the heat went directly into the households. Thus there was no stored heat for use during the winter months. The heating system's ordinary oil furnaces had to be used a great deal.

Unlike Lambhov, Ingelstad used heat exchangers between the different water systems. So instead, the problems at Ingelstad had to do with the blocking up of those exchangers. The reason is thought to be that lime was released into the water from the storage tank's concrete walls, despite the protective sheath placed between the concrete and the water.

In Studsvik, a small office building is heated by movable parabolic collectors that were placed on the cover of the pit in the ground that constitutes the heat storage tank. The system has been in operation since the winter of 1979.

The start of operations was delayed by half a year because of a leak in the pit, which caused all the water to disappear. The solar collectors, which were in the process of being installed along with the cover, fell into the pit and were smashed.

According to the report, the problems do not appear to have been as big in Studsvik as in the other two projects. Some condensation and bleached reflecting surfaces on the solar collectors were noted. The dirt that collected on the solar collectors was washed away by rain, and snow rapidly slid off or melted.

"Simplification Needed"

To sum up, the three authors of the report--Erik Gabrielson, Birger Ludvigson, and Jan-Olof Dalenback--note that lengthy and expensive investments are to be expected when a new energy technology is being introduced.

They recommend that attempts be made to simplify the systems and that Sweden concentrate on developing heat storage systems, which are a special need at our latitudes.

But we would be able to rely on technology from the United States and West Europe when it comes to solar collectors themselves.

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ENERGY

SOLAR COLLECTORS USEFUL AS SUPPLEMENT TO OIL FURNACES

Stockholm DAGENS NYHETER in Swedish 11 Feb 81 p 35

[Article by Mert Kubu]

[Text] It may be worthwhile to invest in a solar collector array just for heating water.

But the conditions are these: the user must live in a detached house with an oil furnace, the solar collectors must last for 15 years, the user must get a tax deduction for interest payments, and the community must subsidize the facility. That was the conclusion reached by the National Consumer Board after it tested 12 of the solar collector systems on the market.

A financial estimate shows, however, that the savings would be about the same if the owner of that same house with its oil furnace installed an electric water heater--and used it during the summer months.

On the other hand, it is not worthwhile to invest in solar heating for a detached house that uses electric space heating. The savings in such a case are doubtful, considering the cost of investing in solar heating.

The National Consumer Board's test results were reported at a symposium in Stockholm on Tuesday. And the tests were concerned only with solar-heated tapwater--not with using solar collectors to heat houses. Many questions were raised in the debate. Many people wanted to know: do the solar collectors last longer than 10 years?

There are five solar collector systems considered by the National Consumer Board to have "the greatest chance of operating for 15 years, which is the minimum required if the installation of solar collectors is to be financially worthwhile for the individual." Those brands are: Ar-Con, Joco, Lordan, Sunterm, and Sun-Unit-4.

The 12 solar water heating systems were tested by the National Institute for Materials Testing, which checked for impenetrability to rain and tested the effect of wind and snow. It carried out thermal-shock tests and froze the solar collectors down to -20°C for 24 hours. Despite those tests, however, it is hard to say how long the systems will hold up. The five brands mentioned above came through the tests with little or no adverse effect.

The systems tested are designed as follows: they have a solar collector surface of 8 square meters. There is access to a 300-liter hot water tank. The hot water has a temperature of 45°C. The house requires 5,000 kWh of energy per year for heating water.

But solar collectors provide from 1,800 to 2,800 kWh for heating water. The oil furnace is shut down completely for 5 summer months. Since the sun does not always provide enough energy, one must invest in a water heater with an electric booster to provide the backup.

The reason why the oil furnace is not used as a backup for heating water during the summer is that it is far too expensive. The furnace is too uneconomical.

A solar heating installation with an electric booster costs about 16,000 kronor. The savings are 800 kronor per year. The government currently provides a subsidy of 3,000 kronor and an advantageous loan of 9,000 kronor. A financial estimate shows that under those conditions, and allowing for interest deductions and marginal tax rates, the solar collectors will pay for themselves in 10 or 15 years--depending on inflation and increases in petroleum prices.

But how long solar installations will last is something that the National Consumer Board does not know. It was discovered that there were very considerable differences in the results obtained from the durability and corrosion tests that were made.

Hugo Larsson warned, "It is wrong to look at this only from the standpoint of the individual's finances. It must also be seen from the standpoint of the national economy. If it does not pay from the standpoint of the national economy, but does pay for the individual, this means that somebody else will always have to pay the cost. And that will be other taxpayers--those using ordinary stoves."

Other warning voices pointed out that we are probably going to have differential electricity rates. In that case, the rates will be lower during the summer, and the profitability of using solar collectors for water heating will drop even further.

Others felt that it would be best to wait and see what kind of energy legislation the government is going to propose this spring, especially in March. Then we will know which energy policy the government intends to pursue. And the National Consumer Board's spokesmen agreed with that.

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ENERGY

FIRST EIGHTEEN PHOTOVOLTAIC POWER PLANTS SELECTED

Paris SEMAINE DE L'ENERGIE in French 2 Mar 81 p 10

[Text] The first 18 pilot photovoltaic power plants have just been selected by the CCE [European Communities Commission] in close cooperation with the member countries. Still being considered is the aid that could be granted under the Community's solar energy research and development program for two other plants, one in the island of Martinique and one in Greece. Total cost of these projects (at least one in each member country) is around 30 million ECU's [European Currency Units], one third of which will be provided from the Commission's budget. The output capacities of the plants will range from 30 kW in the case of the smallest ones to 300 kW in that of the largest one, which is to be built on the German island of Pellworm in the North Sea off the Schleswig-Holstein coast. This will be the world's largest installation equipped with flat silicon panels. These photovoltaic cells operate not only in direct sunlight but also in diffused light and even in rain.

The plants will be built by international consortiums made up of private companies, electric power distribution companies, universities, and regional and national governments. The uses to which they will be put are many and varied: electrification of island rural areas, water pumping installations, purification and desalination of water on islands, manufacturing of ice for an agricultural cold storage plant, supplying of power to a television transmitter, a radio transmitter and a vacation center, management and regulation of an airport electric power network, production of hydrogen for a semiconductor manufacturing plant, and others. In some cases, the pilot photovoltaic plants will be combined with other generators of energy: for example, a natural-head hydroelectric generator, a wind-powered generator, or even solar collectors for the heating of a pool whose pumps will be driven by a photovoltaic generator. In many cases, the surplus power produced by the photovoltaic plants will be fed into the public electric power network. The pilot plant to be installed near Erellos, in Sicily, a Community 1-MW solar energy plant using mirrors and a steam cycle to produce electricity, will be completed by the end of this year. This will provide a unique opportunity for a direct comparison between photovoltaic and thermodynamic solar generators.

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ENERGY

BREMEN FIRMS BUILD ROTOR FOR SWEDISH WIND ENERGY PROJECT

Essen ELEKTRO-ANZEIGER in German No 1/2, 81 pp 5-6

[Article: "Energy Supply--Wind Energy Converter for Sweden"]

[Text] A future-oriented development project ordered by the Swedish Government is currently under way at Vereinigte Flugtechnische Werke, VFW, and ERNO Raumfahrttechnik, Bremen: the construction of a 75-m rotor for a wind energy converter, which is scheduled to start pilot operation on the isle of Gotland as early as 1982.

The converter, named after the Greek God of the Winds, Aeolus, will have a rated output of 2 MWh—an output sufficient to supply 1,000 single family homes with electricity, just to give an example.

The technology applied by the Bremen aerospace companies in building the rotor covers two areas: knowledge of the basics and methods required for dimensioning and designing a rotor blade, as well as mastery of the work procedures and test techniques in order to manufacture aerodynamic components of approximately 35 m in length with sufficient accuracy and a long fatigue life, with the price remaining in the economical range.

During the design phase of the wind energy converter, the rotor operating range and the maximum annual energy exploitation are calculated on the basis of local wind data. Computer programs from helicopter construction have been successfully applied in the course of these performance calculations, which are strongly influenced by the experience in aerodynamics gained in large aircraft construction.

Another requirement for dimensioning is the calculation of the loads which bear on the rotor due to constant rotation, i.e., acceleration during start/stop phases, and due to the wind structure. This is where the load induced by gales becomes particularly important, because these gales play a dominating factor as to fatigue life requirements in certain rotor blade zones.

One important aspect of design control is the vibration analysis in order to avoid frequencies near individual components and to recognize critical operating conditions, e.g., flapping, in time. Due to the large number of possible vibration

forms of the tower, tower head and rotor, the entire system has to be painstakingly calculated in order to exclude load multiplication by resonance and hence the premature material fatigue connected with it.

The development of the plant is subject to the requirement that technological know-how does not necessarily and automatically mean utilization of the most advanced technology at any price. Obviously, a wind energy converter is to gain energy at a minimum price. Manufacturing costs, repair and maintenance as well as plant life are decisive factors. Currently, materials from fiber-glass-reinforced plastic or carbon-fiber reinforced plastic are not being considered for the supporting structure, because their use would be too expensive or too risky compared to the use of metals.

Mixed Construction

During the Aeolus rotor design phase it became obvious that a mixed construction is the most economical solution. With this type of construction, a steel torsion box takes up the loads at the rotor blade, and GFK (fiberglass-reinforced plastic) is used at the aerodynamically shaped front and rear boxes. In order to facilitate maintenance and later control of the metal parts, the outer surfaces of the steel box form part of the aerodynamic contour. This requires extraordinary skills by welding and manufacturing specialists, because the tolerances have to be extremely close due to the aerodynamic requirements.

On the other hand, this type of construction can do without smoothened, glued, or riveted laminates of plastic, which are very work-intensive and also constitute a risk factor for rotor life. Further, such plastic layers make a later check of the metal parts for possible fatigue cracks more difficult, and when using metal in construction it has to be assumed that in spite of the most diligent checks, small grooves or cracks will occur in the material or in the welding seams. This is where skill and knowledge of the technicians in calculating the size of permissible cracks are decisive.

In the case of the rotor blades for the wind energy converter, the maximum loads to be taken into consideration when calculating the statics are negligible compared to the threshold and alternating loads which may impact more than 200 million times. The fatigue calculations known from aircraft construction had to be extended considerably in order to secure a 30-year rotor life. Besides this fatigue life, however, calculations of crack continuation in the field of breakage mechanics had to be further developed in order to predetermine the growth of small cracks, even in thick-walled laminates.

By means of these methods it was possible to establish a safety margin between damaging error dimensions and errors that can be reliably proven in shop practice. Fatigue tests with samples pretreated accordingly have fully confirmed the results of the calculations. At the same time, a crack warning system is tested, which is incorporated into the rotor blades in order to limit the intervals between inspections during later operation to an economical degree with acceptable risk.

The developments for the construction of economical, large wind energy converters are at an advanced stage in the United States, Sweden and the FRG, so that preparations for their application in small series, as was already started in the United States, may be undertaken.

ENERGY

COMBUSTIONLESS, ALL-CHEMICAL COAL GASIFICATION METHOD

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 13 Mar 81
p 7

[Article: "Is Synthetic Gasoline Already Competitive Today? Alkali-Hydrid Considers Its Own Process as the Most Promising"]

[Text] A.L. Alkali-Hydrid GmbH, Wuppertal--In the opinion of this company, synthetic gasoline could be produced competitively today. The basis for this statement is a chemical conversion process developed at Alkali-Hydrid 15 years ago which avoids conventional combustion at high-reaction temperatures. The company claims better overall efficiency for this process without burdening the environment with waste gases. Alkali-Hydrid aims to prove in an economic study that gasoline can be produced in this way from domestic coal at a cost of approximately DM 1.58 per liter and from imported coal at a cost of approximately DM 1.39 per liter, including license fees but not taxes. These costs are based on a plant capacity of approximately 1 metric ton of charge per hour. Lower production costs are expected for larger plants, according to Alkali-Hydrid. As communicated by the company, the difference between coal gasification by this process and all processes known up to now is that conversion does not take place through combustion of the coal, but is purely chemical. The reaction temperature is said to be lower. It can be obtained either by means of electric current or by combustion of coal, which, however, does not take part in the gasification process. Therefore, for gasification of coal by the Alkali-Hydrid process, one differentiates between two methods:

In method 1 heat is produced by means of electric current. Pulverized and dried coal is fed into a mixer which is fed from the circulating system with an alkali hydroxide melt at approximately 450 degrees Celsius. The coal is thus heated to about 380 degrees Celsius. The pumpable mixture flows into the reactor through a pipe. Here almost complete conversion of the reactants is said to be obtained. In so doing, a gaseous mixture of alkali hydride vapor and carbon monoxide gas is formed. The gaseous mixture leaving the reactor is sent to separation column 1 in order to wash the alkali hydride constituent from the CO gas. Separation column 1 is connected to an alkali hydroxide circulating loop which can take up the hydride constituent up to saturation of the melt. Thus, the CO gas leaves the upper part of the column free of alkali hydride.

The hydride-rich hydroxide melt is sent in the circulating loop to separation column 2. In this separation column it is brought into contact with water or with water vapor. This transforms back to alkali hydroxide the hydride constituent of the hydroxide melt, and thus produces pure hydrogen gas. The alkali hydroxide melt is reintroduced into the mixer and is thus not lost to the process. According to this process, carbon monoxide and hydrogen are separately and continuously produced, in equal volume percentages.

In method 2, heat is produced by means of coal. The reactor in method 1 is replaced by a heater-vaporizer. This increases the equipment cost and maintenance downtime. The coal-hydroxide mixture from the mixer is pumped through coil-shaped heating pipes and is thus heated to just below reaction temperature, while the remaining heat is added in the subsequent vaporizer. All other operations proceed as in method 1, namely, in such a way that the gas mixture leaving the vaporizer is sent to separation column 1.

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ENERGY

BRIEFS

SECOND GENERATION COAL GASIFICATION--The "Rheinische Braunkohlenwerke AG" [Rhine Brown Coal Works, Inc.], Cologne, is working as a part of its research program on developing processes for gasification of substances containing carbon. One of these developments is the Rheinbraun [Rhine Brown] high-temperature Winkler process (HTW), which operates at elevated pressure and high temperatures. The goal of the development is production of synthesis gas, hydrogen, or low-BTU gas. Rheinbraun plans to construct a demonstration plant in the Rhine brown coal basin. The firm "Ude GmbH" [Ude, Ltd.] is taking charge of the engineering design of this plant, which is designed for a capacity of 1 billion cubic meters of synthesis gas per year. This gas quantity is sufficient for the production of 1,000 metric tons a day of methanol. In the first phase of construction, one-fourth of this capacity is achieved in one train. Startup is planned for 1983-84. After processing, the raw gas is delivered by pipeline to the "Union Rheinische Braunkohlen Kraftstoff AG" [Union Rhine Brown Coal Fuel Company, Inc.], Wesseling, a subsidiary of Rheinbraun. There it is supposed to replace synthesis gas for methanol production; up to now, this gas was produced by gasification of residual oil. Economic studies have confirmed the advantages of the Rheinbraun HTW process. According to these, synthesis gas can be produced from Rhine brown coal economically in comparison with natural gas or heavy oil as a raw material. The contract between Rheinbraun and Ude specifies that Ude will continue to work as an engineering partner on development of the Rheinbraun HTW process and will make available its capability to design, construct and start up such plants for Rheinbraun and for third parties. [Text] [Duesseldorf CHEMISCHE INDUSTRIE in German Feb 81 p 70] 5586

COAL CONVERSION PLANT APPROVED--The economy minister of North Rhine-Westphalia, Prof Raimund Jochimsen, has approved, in the name of the state government, construction of the first large synthesis gas plant based on brown coal. "Rheinische Braunkohlenwerke AG" [Rhine Brown Coal Works, Inc.], a daughter company of Rheinisch-Westaelische Elektrizitaetswerke [Rhine-Westphalia Electric Utility], will construct the plant by the year 1987 in Huerth-Berrenrath. Investments of DM 400 million are provided for. The plant is to produce a billion cubic meters of synthesis gas annually. [Text] [Duesseldorf EUROPA CHEMIE in German 4/1981 p 34] 5586

SWEDEN'S TEN-YEAR ENERGY PLAN--Prime Minister Falldin released recently the energy plan for the next 10 years that is to be submitted soon to Parliament. The program's main objective is to reduce the part of the country's energy needs to be filled by oil from 67 percent to 40 percent by 1990, representing a decrease of around 12 million tons a year of oil imports. To this end, the plan includes the following measures: putting in service of 12 nuclear reactors; development of hydroelectric energy; exploitation of biomass; use of forestry waste and peat; and importation of coal for thermal generating plants. Energy supply problems are exacerbated in Sweden by the severe regulations on air pollution. This is one of the reasons Sweden is especially interested in methanol-based fuel projects, for common-carrier vehicles, for example (see *SEMAINE DE L'ENERGIE* of 26 January 1981, p 4), whose rate of air pollution is low. The nuclear program was approved by the Swedes in March 1979 despite a fierce campaign against it, and nuclear plants are expected to furnish 47 percent of the country's electricity by 1985 and 55 percent by 1990. [Text] [Paris *SEMAINE DE L'ENERGIE* in French 2 Mar 81 p 3] 9399

PHOTOVOLTAIC CELLS--London--BP [British Petroleum], one of the world's largest oil companies, is entering into partnership with Lucas, an electric and electronics equipment manufacturer, to exploit solar energy. The two companies announced in a joint release on 17 February that they have decided to combine their efforts in this field and concentrate them on photovoltaic cells. These cells convert sunlight directly into electrical energy. To this effect, the companies have formed, with equal shares, "Lucas-BP Solar Systems Ltd," whose first undertaking will be the construction, with financial aid from the EEC, of Great Britain's first solar electric power plant. This experimental plant, with an installed capacity of 80 kilowatts, is to be in service by mid-1983. The company will also carry on research on the technology of these cells to improve their efficiency and lower their cost, which is still not sufficiently competitive. [Text] [Paris *APP SCIENCES* in French 19 Feb 81 p 35] 9399

CSO: 3102

INDUSTRIAL TECHNOLOGY

ELF-AQUITAINE PERFECTS ROBOT FOR DEEP-WATER OPERATION

Paris AFP SCIENCES in French 19 Feb 81 pp 20-21

[text] Libreville--A robot for deep-water petroleum -- The Elf-Aquitaine group has successfully completed construction of a submarine robot which will open the way to exploitation of petroleum and natural gas in deep water.

The performance test undergone by TIM (intervention and maintenance remote handler) was the last stage in experimental operation at a depth of 60 meters on the Grondin offshore deposit (150 km south of Libreville), of an automatic submarine production platform which is operational at depths of up to 1000 meters.

The stakes of this project are sizeable. Sedimentary basins likely to contain hydrocarbons extend much beyond coastlines and anticipated offshore reserves are immense.

Until now, petroleum technology has cautiously stayed away from coastal areas, relying on land-tested techniques. From early drillings at 10 meters depth to the recent Cognac platform (Gulf of Mexico), each of whose metal pilings is higher than the Eiffel Tower by a head, the principle has remained unchanged: production installations, whether steel or concrete, are above water, and rest on the bottom. This is primarily due to safety reasons.

The wellhead which regulates the oil flow and makes it possible to reach the interior of the well must be accessible at all times, during the 10 to 20 years generally devoted to the exploitation. In addition, the connection between surface and bottom must remain rigid.

But for production at more than 200 to 300 meters of water, use of a submarine platform seems the only way of going deeper, with the additional problem that the installation becomes inaccessible to divers. In this matter it seems that Elf-Aquitaine has gained an advantage.

In 1974 the group began a submarine platform project, with a final development cost of 300 million francs. Since 1976 three giant wells have been drilled side by side, to the northwest of the Grondin field, and have been capped by a platform supporting three underground wellheads and a control unit.

Instructions issued from a surface installation are transmitted by electric cable to the control unit which regulates each well's output by means of conventional hydraulic valves. The unit also operates control devices such as pollution or silt protectors.

Overall design is of relatively simple and therefore reliable technology; it makes it possible to perform routine operations without surface equipment intervention.

For more complex operations, requiring additional equipment, a mobile, powerful, accurate tool was needed, capable of operating without time or climate restrictions. TIM, the robot designed by Elf-Aquitaine research, has been operating at Grandin Northwest since 1979. Built by MATRA and by shipyards in Bretagne (Nantes), its development cost reached 20 million francs.

Equipped with 2 telescope arms ending in jaws, and with a crane which can move 1.1 tons, TIM "sees" thanks to five video cameras and 10 floodlights. The entire assembly (12 t with carriage platform) is "parachuted" when needed from the monitor barge where it is stored, and is guided toward the platform by two stretch cables. Once positioned on two rails running the length of the platform, TIM can begin to operate.

On the barge, the device's pilot, sheltered in his control cabin, easily manipulates loads of 10t kg at depths of 50 meters, thanks to images transmitted to him by five TV screens. With TIM he can make petroleum, hydraulic, or electrical connections.

After 18 months of perfecting, TIM will soon return to France. Francois Bernard, Elf-Aquitaine director of research and production, as well as the father of the submarine station and its robot, states that "all operations planned have been performed. Now we know it works."

Two applications in Norway will continue to add to the experience acquired in Gabon. In the North Sea, the French group decided last May to exploit, northeast of the Norwegian field at Frigg, a satellite deposit of 14 billion cubic meters of natural gas, thanks to a submarine platform installed at a depth of 100 meters. The innovation is that the installation, simply monitored from a small surface platform, will include a device making it possible to kill the well by remote control. Drilling is to begin in September 1981 and production in 1984.

Still in Norway, the SKULD project (Norwegian mythological character symbolizing the future and necessity), provides for production of natural gas using a submarine platform which in this case will be installed 20 km away from a surface platform. The installation will be radio controlled by a surface buoy.

For Elf-Aquitaine, bringing submarine operations from the experimental to the industrial stage is above all an answer to its own need to exploit its own deposits. But it is known that from 1975 to 1981, worldwide orders for wellheads have risen from about 10 to about 50 units per year.

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TRANSPORTATION

'RESEARCH CAR' PROGRAM CONTINUES AFTER FUNDING CRISIS

Bonn DIE WELT in German 7 Mar 81 p 17

[Article by Bodo Grosch: "How Bonn Is Economizing on Research Vehicles"]

[Text] The void in the state budget is endangering an ambitious goal: the development of the automobile for the year 2000. Since 1978 VW, Audi and Daimler-Benz have been working on research vehicles which are to be particularly economical, safe and comfortable. In addition, a university research group has been experimenting with a similar project, the "Unicar." While the last-mentioned is being financed completely by the state, the Ministry for Research has a 50-percent involvement in the other projects. A total of DM120 million was to be made available for the research vehicles. Minister for Research Andreas von Buelow planned to present the individual vehicles at the International Auto Show in Frankfurt in September. But then the budget committee spoiled his plans: it wanted to reduce the research minister's budget drastically. In recent weeks the "Unicar" project in particular appeared to have fallen victim completely to the red pencil.

In the last few days, however, the situation in Bonn has changed. "The Unicar project is no longer in danger," confirmed Magret Kittelmann, spokeswoman for the minister for research. Funds for its completion were available. But VW, Audi and Daimler-Benz will have to accept cuts for their research projects. As Magret Kittelmann said: "The money will not flow quite as freely."

The Ministry for Research and company representatives are still engaged in tough negotiations about how to continue with fewer millions. For, after all, the purpose of this project is still to assure the technological lead of German auto companies in the world.

At the beginning of development, the requirements for a car in the year 2000 were examined. A study by Daimler-Benz showed:

--the working week is getting shorter, demand for annual vacation time is increasing;

--retirement age is dropping, more retirees than ever before will hold a driver's license.

Conclusion: An increase in free time and vacation traffic. Since only one-quarter of the distance driven by these vehicles is in built-up areas, and correspondingly more on autobahns and main highways, vehicle performance and driving comfort must not be overlooked, as well as safety, less environmental pollution and economy.

A look at the design offices shows what the results have been so far. Research vehicles have a lot of electronic circuitry and other technical tricks to reduce fuel consumption and noise and improve exhaust emissions readings. These are the details of the four research vehicles.

Mercedes

Comfortable five-passenger sedan. Optional engines are a gas turbine, 3.2 liter V-8 gasoline engine with progressive cylinder cut-out, or a 4.4-liter V-8 diesel engine, all with 150 hp. It has an electronic-hydraulically shifted transmission, with a choice of "city driving," "economical cross-country driving," and "fast cross-country driving."

The safety package ranges from aids for starting from rest, braking and steering through airbags, radar measurement of the distance between cars, to air-conditioning to reduce fatigue on cross-country journeys. Trip computer (fuel consumption) and route calculator (shortest way) and emergency radio are planned. Wind resistance will be reduced considerably by optimizing the front end area with ducting for cooling air, smooth sides and a fully enclosed underside. Now, for reasons of economy, only one example of the three planned will be built.

Audi

The body construction is the most immediately noticeable part of the Audi research vehicle: The floor section, including the seats, and the roof are made of sandwich-formed plastic and pressed into the body. To protect pedestrians, the front of the hood has a deformable interlayer.

The engines under development are a 1.7-liter gasoline engine with cylinder cut-out, electronic ignition and knock sensor, consumption of about 8.5 liters/100 km; the 2.0-liter, 5-cylinder diesel engine, which has been under development and consumes about 7 liters/100 km, will probably be dropped. Maximum speed is estimated at 180 km/hour, acceleration from 0-100 km/hour in 13 seconds. The vehicle has front-wheel drive and a manually shifted 5-speed transmission, with 5th gear designed as an economy gear. In dimensions and comfort the car will correspond roughly to the current Audi 100.

Unicar

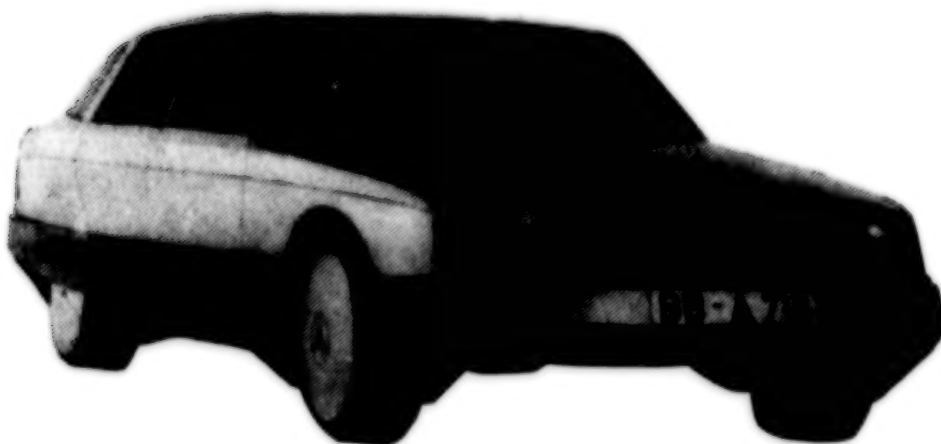
Under the direction of Professor Breuer, the work group from the universities of Aachen, Berlin, Stuttgart and Darmstadt have developed a middle-class 4-passenger automobile, with a 400 kg load capacity. The engine is a 2.5-liter, 4-cylinder turbocharged diesel, developing 102 hp. The front-wheel drive car will have a top speed of 170 km/hour. Power is transmitted through a continuously variable mechanical transmission, engine-transmission functions are controlled by a computer.

A hydrodynamic clutch helps while starting from a stop. The aerodynamically efficient body (C_d .25) is "padded" at the front and designed particularly with pedestrian protection in mind. It has pneumatic central door locking with automatic unlocking in the event of an accident. ABS anti-locking system brakes. In order to economize, only one drivable model and three demonstrators will be built.

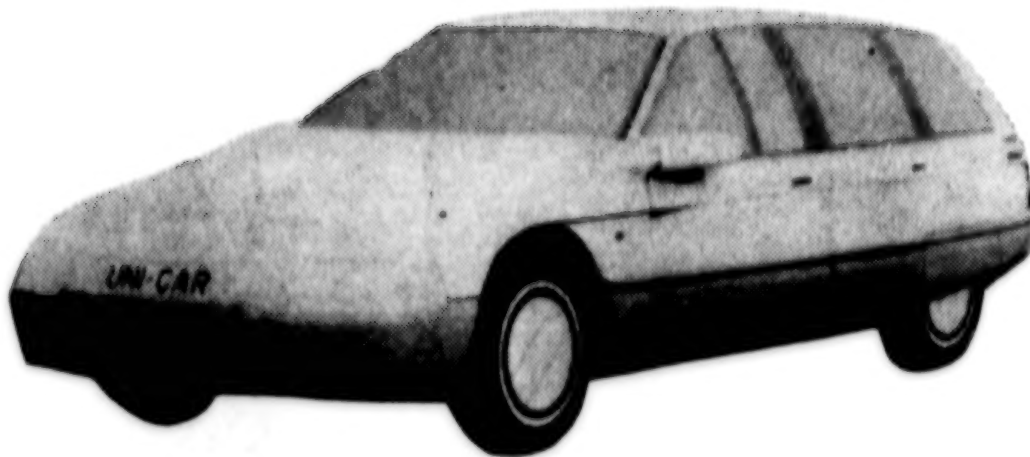
Volkswagen

Wolfsburg has set ambitious goals for itself in the smallest research project class. The vehicle is to have the dimensions of a Rabbit but will be extra-light through the use of plastics. There are even ideas for a plastic rear axle, but at the moment it is still too expensive. Plans call for turbo-charged engines of small capacity. For example, a 1.2-liter 3-cylinder diesel producing 55 hp and with a fuel consumption of 5.5 liter/100 a high-compression (12:1 or 13:1) 4-cylinder gasoline engine producing 75 hp. A planned methanol engine will be dropped because there are no research funds.

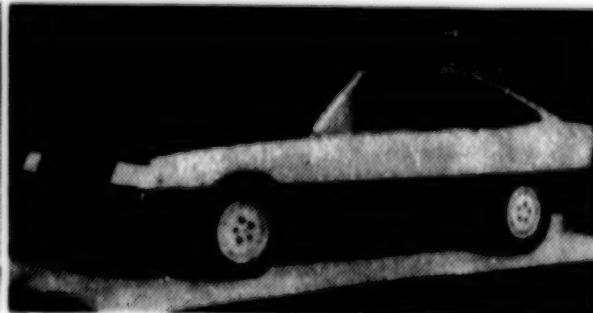
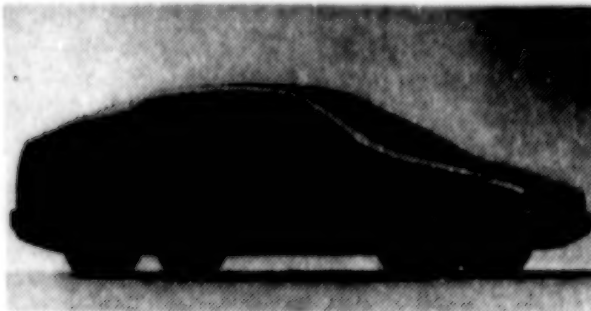
Low weight (650 kg), low wind resistance (C_d 0.25) will ensure good acceleration and a top speed of 140 km/hour. There is a lot of electronic gadgetry at VW, like an engine-transmission management system. Work is being carried out on an automatic flywheel system with two clutches, plans include the ABS brake system. The diesel engine can be fully enclosed.



Only one of three planned prototypes will be built: Daimler-Benz research vehicle with gas turbine engine.



Only one drivable version of the Unicar will be built, as well as three demonstrators. Engine: 2.5-liter diesel.



Because state assistance is not available VW will drop a methanol engine for its research vehicle.

Cut from research plans: 5-cylinder diesel engine for the Audi research vehicle.

9581

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TRANSPORTATION

BRIEFS

PEUGEOT CREATES RESEARCH OFFICE--Paris--New structures for scientific research and innovation at Peugeot--On 9 February the Peugeot S. A. Company announced the establishment of a Department of Scientific Research and Activities (DRAS), whose function will be to promote and develop advanced technology for automotive products and means of production. This new department will be headed by Michel Durin, Doctor of Science and former Director for General Methods with the Citroen automobile company, and will notably involve electronics and automation. DRAS will rely on Peugeot's technical management and will use resources now available among the group's companies. Peugeot also established the position of innovation advisor to the board of directors, filled by Mr Perrin-Pelletier, who will provide data on current innovations in all fields, in France as well as abroad, and who will suggest methods for adaptation. A former student of the Ecole Polytechnique, Mr Perrin-Pelletier was a member of the Peugeot automobile directorate and chairman of the Talbot automobile directorate. He is also a member of the innovation commission at the ministry of industry. [Text] [Paris AFP SCIENCES in French 12 Feb 81 p 6] 11,023

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